Legibility for Users with Visual Disabilities

Abstract: Considering that the aim of the research was to highlight the role of design and designers think about wayfinding for the disabled. Then, cases studies will help to describe the real life context in which a phenomenon is involved, and explain complex casual links in real life interventions. In order to ensure validity, objectivity, and accurately information the following requirements were considered: Talking Signs, Tactile Maps, Floor Markings, Dual Signs, Color Contrast and Sans-serif Letters [3].

In conclusion, wayfinding systems are very important for disabled users and also guidelines recommended by the ADA and ANSI which includes the use of certain fonts, sizes, colors, contrasts, shapes, symbols, finishes, heights, and legibility. It is also recommended that a standard system be used to reduce confusion among users and to make it easier for new signs to be made [4]. Hopefully these guidelines and new ideas for identification and instructional signage will help make a more effective and easily manageable system for the disabled users and for the entire population [5].

Key words: Wayfinding, Disabled, Sign System, Ssignage, Environmental Graphic Design.

1.Introduction

The aim of the paper is to show projects of wayfinding for the disabled based on new design codes and also to highlight the work of the designers, as Coco Raynes and Roger Whitehouse and finally case studies, as Lighthouse International Headquarters in New York designed by Roger White will help to describe how a good design could help blind and visual impaired users navigate their environment safely. In order to ensure validity, objectivity, and accurately information the following requirements were considered: Talking Signs, Tactile Maps, Floor Markings, Dual Signs, Color Contrast and Sans-serif Letters.

1.1. Structure and Description:

The first part of the paper presents: the disability groups and the design codes:

1.1.1. Three Groups and their needs

The design code and the designers' work are geared toward three primary disability groups. They have direct ways of navigating their environment and have special needs each one distinct from the other:

The Blind -The blind cannot see signs, interior changes, color, or type. What the blind can "see" are people and spaces thought hearing and touch. The blind have a strong understanding of 3D space and the position of their bodies in it. When walking, they expect information to be where their hands fall and where their feet and cane make contact. The blind can also receive directions by following the flow of people and asking questions. The functionally blind make up approximately 2-3 percent of the population.

The Visually Impaired - Users with impaired vision require more signs than other people. They have greater need signs because they don't see their surroundings as well as others do. The visually impaired can see, but with great difficulty, especially type and color. They focus on many directions of one time and are always trying to focus on type information because they have a hard time seeing anything immediately. People with visual

disabilities are easily disoriented, especially by small type. People with visual disabilities make up at least 25 percent of the population. Among people older than 65, this figure can rise as light as 75 percent.

The Physically Disabled - The physically disabled navigate their environment based on what services have been set up to meet their needs. Cub cuts in sidewalks, elevators, wider doors and bathrooms, and ramps are all physical additions to service the needs of this group. While paper does not focus specifically on the wayfinding requirements of this group. It is certainly built around the architectural design of the environment and whether improvements for the physically disabled are central to the design or a hidden background to the usual wayfinding process [6].

1.1.2. Design Codes

Until the twentieth century, the idea of the blind and visually impaired being able to navigate their environment was given no thought. The disabled stayed home or lived in special environments that could cater to their specific needs. Starting in 1929, with the establishment of the world's first seeing-eye dog school in Nashville, Tennessee, the blind began to gain the ability to navigate their environment, though interiors remained enormous problem. There were hardly any signs available for the blind. Buildings also were not geared to the physically disabled, with multiple stairs and a few maps. From the 1970 the sign designers began to create the first signs in Braille and raised letters that the blind could read. Researchers developed a better understanding of legibility issues related to color contrast and type size. Ramps began appearing as regular feature in buildings. Many organizations focusing on rights for the disabled began to develop laws that would protect their right to navigate the world unassisted. In the late 1980s, all this came together in the first national laws in the United States and the United Kingdom. Designers made efforts to create the first coherent and justifiable design standards were soon being made. Today an entire industry, as well as an academic and research base, has been built to meet the wayfinding needs of the disabled. Education efforts also began to pick up in the 1990s. Spearheaded by the Society for Environmental Graphic Design in USA and groups such as NHS Estates in UK (since November 2001, CHAD - The Centre for Healthcare Architecture and Design), designers began to see how to best implement projects based on the new design codes.

The American with Disabilities Act (ADA) - The United States passed the first codes that mandated signs for the blind. The most prescriptive codes, specifically, mandating a tight range of fonts, styles, sizes, and widths, as well as the placement of Braille and signs themselves. Recently the code has been advanced by recommending the separation of sign information for the sighted and the blind [7].

The UK and Europe -While Europe lags behind the United States in specific enforced sign codes, a number of countries have endeavored to create clear, consistent, yet flexible codes and have promoted them through an educational process. The United Kingdom has gone farthest in this area, introduction of new codes from Disability Rights Commission (DRC) in the 1990s. October 2007 the (DRC) was replaced by a new Commission for Equality and Human Rights (EHRC) with powers across all equality law (race, sex, disability, religion and belief, sexual orientation and age). The codes describe "reasonable accommodations" and focus on a range of design solutions instead of specific measures.

The European Institute for Design and Disability (EIDD) and Institute for Design and Disability (IDD)- The Institute for Design and Disability (IDD) is the Irish member organization of the European Institute for Design and Disability (EIDD). Through the EIDD, it has liaison arrangements with the European Parliament and Commission, the European Disability Forum, and sister organizations in 15 countries. The Institute for Design

and Disability (IDD) was established in 1991 following the European Conference on Design for Disability held in Dublin in 1989.

Portugal has 163 thousand people with visual disabilities (CENSUS 2001) and CEBV in Lisbon, thinks that they are now about 210 to 220 thousand. Among people older than 65, this figure can rise as 40 percent. In this country, there is no special wayfind design for them. The objective of the paper is to show examples, which could help blind and visual impaired users navigate safely their environment in countries like Portugal.

2. Methodology

The paper shows graphic systems used by designers based on ADA's codes and new technologies to assist in wayfinding for the blind and visual impaired.

The principal aspect of designing for different groups of the disabled is balancing the separation of sign information between people with visual disabilities and the blind. Like this is possible to meet the needs of both groups in one sign. This issue permeates nearly every aspect of the design codes, including those discussed below:

Location of Sign Information - To the blind, signs are all about tactility, which means that the placement of Braille and symbols is specified in most sign codes. Type should be directly above Braille and at specific distances in most of these codes. This restricts the location of information on signs, unless the same sign information is repeated in other locations. Many designers solve this issue by creating a "double sign," or a sign that contains both tactile and visual information, thereby duplicating information.

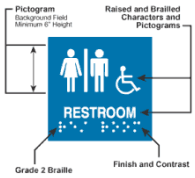

Figure.1 "Double sign," (the sign contains both information, tactile and visual)

Position of Signs -The blind also need to be located in specific places. Since most sighted people see information more easily when it is overhead or away from the clutter of the immediate environment, most codes have had to divide "directional" signs (signs with information directing the user to a specific location), and "identity" signs (signs that identify a location). Directional signs only need to respond to the visually impaired, while identity signs need to respond to both groups [8].

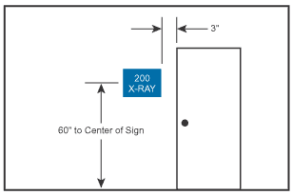

Figure.2 An example of the position of the sign at the wall

Color Contrast and Lighting - Considerations regarding **c**olor contrast and lighting are not an issue for the blind, but they are the most crucial issues for people with visual disabilities due to age. As the eye ages it is less able to differentiate color [9]. The most sign users need high-contrast signs as well as adequate lighting for them to be legible. Color contrast also provides another rationale for the separation of signs for the blind and signs for

the visually impaired. Since a tactile sign does not need to be seen at all, by separating them, the tactile sign can be all but invisible.

Figure.3 An example of color contrast sign

Tactility Signs -Tactility also separates the needs of the blind from those of the sighted. Since blind people read by touch, sign elements must consist of raised surfaces, or should be placed on a table-top or on a diagonal surface to enhance ease of reading. Signs for the sighted are better read vertically. Even shadows cast by tactile signs can confuse a visually impaired reader.

Figure.4 An example of a Tactility Sign

Typography- Type fonts are one area in which the needs of the sighted and blind are the most distinct. The blind need sans serif fonts that are ½-1 inch (1.3-2.5 cm) in size, and spaced far enough apart to allow for reading by touch. Lettering for the sighted usually needs to be as large as possible, and to have a wide variety of type fonts. The blind also find it easier to read letters that are all upper case, in contrast to the sighted, for who upper and lowercase is more legible.

Figure.5 An example of sans serif font

New Technologies

Some designers today have used new technologies to assist in wayfinding for the blind through both audio and positioning devices. These technologies include:

Talking Signs - Talking Signs are simply signs with an activating button or sensor that allows the signs to "talk," giving identification, directions or other information. This technology is an infrared wireless communications system that provides remote directional human voice messages that make confident, independent travel possible for vision impaired and print-handicapped individuals. The system consists of short audio signals sent by invisible infrared light beams from permanently installed transmitters to a hand-held receiver that decodes the signal and delivers the voice message through its speaker or headset. The signals are directional, and the beam width and distance can be adjusted. The system works effectively in both interior and exterior applications.

Talking Signs may be used wherever landmark identification and wayfinding assistance are needed. To use a Talking Signs system, the user scans the environment with the hand-held receiver. As individual signals are encountered, the user hears the messages.

Figure. 6 An example of talking sign

GPS Technology, Infrared and Wireless - Whatever type of technology is used, the idea that a handheld device can read information on a place is coming ever close to reality. Properly explaining directions will be crucial. Whatever does get selected, providing proper environmental cues will be just as important as the information placed on the handheld device.

When walking along streets or inside buildings, it is important for people with visual disabilities to acquire environmental information in order to update their mental map for accurate orientation as well as to ensure safe mobility. Various devices have been developed to acquire this information, but many problems remain unresolved. To overcome these difficulties, it was developed two new additions to a Remote Infrared Audible Signage System (Talking Signs(r)) for use by people with visual disabilities that they can use not only in public places but also in the personal environment of their daily life. These efforts are currently taking place through a joint Japanese-U.S. company collaboration. Wayfinder Access is an innovative GPS solution from the Swedish company Wayfinder Systems AB [10]. This application for Symbian phones is designed especially to work with screen readers like Mobile Speak or Talks from Nuance Communications and text-to-speech technology, and takes into consideration the special needs of the blind and visually impaired. With Symbian screen reader software, however, the visually impaired and blind get more than just the reading of the application's screens, but also a Braille support.

Case-Studies

The validation studies are based on case-studies:

Once considered a necessary tool of information—a growing number of people in the design, construction, development, and policy arenas have gained an appreciation of signage and environmental graphic designs for disabled in humanizing and demystifying the complexities of the built environment. They have found that well-designed signage and environmental graphic programs not only fulfill their communication function of informing, directing, and identifying the users, also serve to enhance the aesthetic and psychological qualities of an environment.

Coco Raynes, is one of the leading international designers of signs and informational graphics for the disabled. Some of her important projects include Paris Charles De Gaulle Airport, Museo Nacional de Colombia, Bogotá, Colombia Master Plan for an Educational Tactile Itinerary. Implementation Phase 1: Pre-Colombian to XVIIe Century, 1999 and Ministère de la Culture – Direction des Musées de France.

Figure.7 An example of Tactile Itinerary

Raynes has specialized in using tactile and audio information. Tactile Maps, incorporated into directories and information tables, have been implemented in the programs for transportation and healthcare facilities, museums, parks, libraries, universities, corporate and retail buildings. Raynes' two significant innovations include: The RaynesRail is designed to comply with the true intent of ADA, the Braille and Audio Handrail System makes public buildings, parks, transportation facilities and museums accessible to everyone. The Rail provides blind travelers with a degree of independence previously unattainable in unknown surroundings. The Braille and audio messages provide directions, describe open areas, traffic patterns, and warn of ramps, stairs and turns. In museums, the audio provides cultural information.The audio units, with multi-lingual capabilities, are integrated in the Rail at strategic locations. Activated without any devices, they make the Rail a universal solution to be used by all.

Figure. 8 The RaynesRail is designed to accessible to everyone**.**

The floor markings are often incorporated into the accessible wayfinding programs. These slightly raised dots are mounted on the floor to further delineate the circulation path. The dots can be followed visually, or by foot, and make a sound if tapped with a cane. Raynes has utilized floor markings for large facilities such as airports to give them more freedom.

Figure.9 The floor markings are incorporated into an accessible wayfinding

Roger Whitehouse has been a pioneer on understanding the legal aspects of, and in designing for the disabled. Roger Whitehouse, Nora Olgyay and Ken Ethridge wrote the ADA White Paper for the SEGD. This laid out the guidelines for American signs and best practice for utilizing them. Roger has also conducted extensive research on design for the blind on behalf of the Lighthouse International Headquarters.

Roger has been a prominent advocate for the adoption of design principles to assist in making the environment accessible for the blinds and impaired users. The proposals that he created, for vision-impaired users among others, include audio-visual wayfinding landmarks, a custom typeface for tactile reading, and a wayfinding device called BrailleRail.

The Lighthouse International Headquarters in New York is one of the few buildings in the United States specifically planned to integrate the needs of people of all ages who have a broad range of vision, hearing and mobility impairments. The building is a "working laboratory" where many design features are test for the first time. In creating the building, architects and designers were guided, every step of the way with information from the Lighthouse vision researches and other staff experts. The Lighthouse consumers provided their input regarding lighting, signage, color contrast, audible communications, safety and orientation, and mobility issues through extensive testing and research... The resulting design had to fit the needs of a varied group without cluttering the space and impairing wayfinding. The architects and lighting designers began by developing a clear plan that eased wayfinding through the building. Some of the innovative features include: **Easy-to-navigate-** The architects designed a functional entryway that is divided by a railing, separating people who enter and leave the building. At the main reception desk, tactile and large print maps of the public floors help the consumer's plan their routes within the building. The recessed waiting area in the lobby has space below the bench seating for guide dogs.

Figure. 10 Easy-to-navigate

Full Light- Bright natural light from the oversized windows and custom-designed, non-glare artificial light fixtures throughout the building produce a soft light that avoids dramatic changes in level or intensity.

Contrasting Colors- Since loss of ability to perceive **c**olor contrast is one of most common effects of vision impairing, strong contrasting colors, warm white walls with magenta door trims are used trough the building. Floor tiles, in shades of dark purple and mauve, point out elevators and safe travel paths, and color and texture contrast between walls and floor, on stair treads, and along edges of desks also help maximize ease of use.

Figure.11 Room Identification

The Wayfinding Approach - Roger Whitehouse worked to support the innovative design features throughout the building with a sign system that could support people with varied disabilities. The designer began with extensive research measuring how the blind read, including how they read test symbols and maps. Whitehouse coupled this research with observations on how the blind and people with physical handicaps navigate space.

The results of Whitehouse's research found their way into a number of design features in the wayfinding system. The first was the observation that the blind felt more comfortable reading Braille and tactile letters set at an angle. This led to the simple, but innovative angled Braille signs and maps that are positioned at a comfortable height for reading. Another important research result that affected Whitehouse's design was that the blind feel much more comfortable following a continuous rail system that connect the signs. The design approach that answered this development was a tactile element that connects each room identification sign. Additional information along the path directs users to the elevators. The map design was another balancing act between the

needs of the blind and those of the visually impaired. The represents a full and complete raised floor plan that is mixed with Braille information, thereby providing a clear view both for blind and the visually impaired.

Balancing the needs of the blind with the needs of the visually disabled is also important to the sign system. The Braille and the raised letters for the blind are very low-key and unobtrusive, while the visual letters and symbols used are large, with a high color contrast. The typefaces involved also aided in wayfinding by using the designer's Haptic typeface. This includes a distinct cross section, large open counterpaces and the exaggeration of unique letterform characteristics, such as a slash through the zero to differentiate it from the letter "O" and an open-top numeral "4" to differentiate it from a capital "A". One innovation that the designer incorporated at the Lighthouse that is now being integrated into many building is the talking sign [11]. These signs identify conference rooms, restrooms, and stairways out loud to users carrying special handheld receivers. The elevators feature a special enunciation system that identifies each floor and directs people toward the reception desks, where floor-special tactile maps are located. The Lighthouse International Headquarters may have taken the leadership approach to wayfinding for the blind and visually impaired, but all the design innovations can be incorporated into any facility.

3. Results and Discussions

Reopened on June 20, 1994, the Lighthouse's headquarters offered people of all abilities an opportunity to experience and give feedback on the concept of increasing independence through a more universal approach to wayfinding and graphic design [11].

Lighthouse staff took advantage of every opportunity for feedback from visitors to the building, whether they were nondisabled, visually-impaired, or cognitively or physically impaired. What they learned about signage, symbology, typefaces, and wayfinding became invaluable to graphic designers to learn to deal with these issues, not only in architectural graphics, but also in graphic user interfaces, and also in other areas of the graphic design. Upon completion of the project, Steven Goldberg of Mitchell/Giurgola Architects observed, "I don't think any of us who worked on the project will ever look on architecture the same way again" [12].

In Portugal where the wayfinding is very difficult for a disabled person navigate safely, however, the designers should outline a practical and comprehensive design method to wayfinding, using an inclusive design approach. The design guidelines should assist designers as well as developers, property owners and property managers in identifying ways of improving access to, into and through their new or existing property, particularly buildings and large complex facilities. The material sources include expert knowledge from architects, landscape architects, lawyers, engineers, building surveyors, building regulators, access consultants, local expertise and persons with a disability. In old and new buildings the clients commissioning the works should ensure that early consideration be given to making sure the building is accessible to everyone. In order to ensure that accessibility is seen as an integral part of the design process the client must emphasize the importance of accessibility when briefing their architect.

Design solutions and strategies that are useful, on-demand navigation information and aids for people who are blind or vision impaired, describing the environment and assisting them plan to reach their destinations. The following brief list provided in this section highlights some of the important issues that must be considered when providing a fully inclusive built environment:

Entrances -The entrance should be clearly distinguishable from the façade (use of glass, should be indicated clearly however fully glazed entrance doors should be avoided and also color contrast issues considered); Signs should be provided indicating entrance and directions to other parts of building; The door should provide a clear open width of at least 1m;Revolving doors should be avoided; Sliding electric doors are preferred option (consider open time).Powered doors can be provided, ideally using an infra-red operating mechanism (consider open time);Outward opening doors should be protected / recessed; Door closers on manual doors should be adjusted to minimum force necessary to open. Thresholds, entrance mats and changes in floor finishes should be flush; Door furniture provided should be easy to use and identify; and Lobbies need careful consideration.

Reception areas - Transitional lighting should be considered; Should have ample circulation space and have clearly defined (i.e. consider color contrast ;for carpet / skirting / walls) and unobstructed routes (i.e. recess radiators and fire extinguishers etc) to other parts of the building; Low level reception desk; Adequate seating / waiting area should be provided; Tactile plan of the building; and Information / Signage.

Doors often present the most problems for disabled people; Doors should have a minimum clear opening of at least 800mm, anything in excess of this is advisable i.e. 1m clear opening; Double doors should provide above opening through one leaf; Door frames / door / door furniture should have color / tonal contrast; Door furniture should be easy to use; Doors should require minimum force to open, consider providing automatic opening doors or electromagnetic catches linked to fire alarms; and Vision panels must be provided in internal doors.

Corridors / circulation -Clear circulation space in open plan areas and corridors should be at least 1.2m; In large open plan areas use floor finishes to define routes; Corridors can convey information and assist (or hinder) circulation and emergency evacuation; Avoid projections or outward opening doors on corridors; Recess radiators and other equipment; Avoid glazing at ends of corridors; Ensure lighting is adequate and does not create glare or silhouettes; Choose color schemes with good color and tonal contras; and Choose floor surfaces carefully.

Vertical circulation - For buildings of two storey or more suitable means of access must be provided to floors above ground; Passenger lifts are the preferred option; They should be at least 1100mm x 1400mm and have a door with a clear opening of 800mm. Larger lifts are preferred and reduce waiting times in larger buildings; A handrail should be located at 900mm high around the inside of the car; Audible and visual information should be provided to identify floor level and door opening / closing. The door should stay open for at least 5 seconds; A mirror should be placed on rear wall of the car; An emergency phone should be provided and clear instructions on how to use it provided; A clear area of 1500mm sq. should be provided outside the lift; and Consider using a dual supply lift that is capable of use in an emergency.

Signage- Signs should be located logically and easily identifiable; They should not cause obstruction; Care must be taken to provide good contrast; Do not locate behind glass; Use recognized symbols, color coding to supplement written information; and Consider using tactile signs where they can be easily reached.

Lighting - Good lighting is essential for everyone; Transitional lighting at the main entrance must be considered; Critical areas like stair-wells, corridors or other changes in level along routes need to be looked at and lighting levels increased; Good management can maximize the amount of light available; Position lights where they will not cause glare, reflection, shadows or pools of light and dark; and Fluorescent lights create a magnetic field and cause a hum for hearing aid users.

4. Conclusion

The aim of paper is to help designers who are not well acquainted with theories and practices of inclusive design and wish to learn more, and possibly to some authorities/countries who are not so sensitive or well qualified to help their disables. It shows a detailed presentation that can help architects/designers of developing countries involved in inclusive design. These design guidelines are based on current understanding in cognitive psychology, linguistics and best practice in orientation. [13].The provision of good access and facilities can be seriously undermined if it is difficult to find the way around a building. Good signs and wayfinding guidance are an essential part of any successful access strategy. Buildings should be designed in a way that makes it simple for people to find their way around. Although some way-finding aids are specifically designed for people with particular impairments, they are usually helpful to everyone. An environment developed with the needs of people with physical, sensory or cognitive impairments in mind will also be a much easier environment for all users to find their way around. For example, many signs fail to meet the needs of people with learning disabilities because they contain too much detail. Successful signs are clear and simple, and use common, consistent language and symbols.

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